Africa Research in Sustainable Intensification for the Next Generation

Impact of Sustainable Intensification on Landscapes and Livelihoods

Scope of Work
Version 6

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The Africa Research In Sustainable Intensification for the Next Generation (Africa RISING) program comprises three research-for-development projects supported by the United States Agency for International Development as part of the U.S. government's Feed the Future initiative.

Through action research and development partnerships, Africa RISING will create opportunities for smallholder farm households to move out of hunger and poverty through sustainably intensified farming systems that improve food, nutrition, and income security, particularly for women and children, and conserve or enhance the natural resource base.

The three regional projects are led by the International Institute of Tropical Agriculture (in West Africa and East and Southern Africa) and the International Livestock Research Institute (in the Ethiopian Highlands). The International Food Policy Research Institute leads the program's monitoring, evaluation and impact assessment. http://africa-rising.net/

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Contents

1. Introduction

The United States Agency for International Development (USAID) has long supported sustainable agriculture that balances the need for increased agricultural productivity and environmental sustainability. USAID proposes to improve the impacts achieved through its investments in food security, climate change mitigation, and biodiversity conservation by designing integrated projects across scales and sectors. Three Washington-based USAID bureaus — the Bureau for Food Security (BFS), Bureau for Economic Growth, Education, and Environment (E3), and Bureau for Africa (AFR) — and the USAID/Zambia Mission have agreed to support an integrated study that advances our understanding of the landscape level implications of farm-level sustainable intensification (SI) activities in Zambia that will also inform the design of integrated projects in the future.

The objective of this study is two-fold:

1. Provide an evidence base for the links between field and farm-scale sustainable intensification (SI) interventions[1] and climate change mitigation and biodiversity conservation in Zambia; and

2. Provide recommendations to inform the design of integrated programs involving agriculture and environmental conservation for USAID programming in Zambia and other regions.

Although this research study is focused in Zambia, it will hopefully provide lessons that are relevant in many other countries about how to effectively build integrated programs that build resilient households and agricultural landscapes while also contributing to climate change mitigation and protection of biodiversity.

2. Context

To significantly improve their economic and nutritional status while minimizing habitat loss and greenhouse gas emissions, smallholder farmers in Sub-Saharan Africa requires multi-functional approaches that provide near-term livelihood benefits for them and longer-term environmental benefits beyond their farms.

Rising demand for food to feed a rapidly growing population, coupled with socioeconomic and demographic drivers, is promoting both land conversion and unsustainable agricultural intensification, reducing the resiliency of households dependent on agriculture and the landscapes on which they depend. These activities are occurring at great environmental costs, including increased greenhouse gas (GHG) emissions, deforestation, and loss of biodiversity. Deforestation and land conversion for agriculture are the largest sources of GHG emissions and biodiversity loss in Sub-Saharan Africa (Archard et al., 2002; Rudel, 2003; Foley et al., 2005). Unsustainable practices often render the soil unproductive, forcing smallholders to acquire new

[1] Sustainable intensification is defined, for the purpose of this SOW, as a practical pathway towards the goal of producing more food with less impact on the environment, intensifying food production while ensuring the natural resource base on which agriculture depends is sustained, and improved, for future generations with a focus on conservation agriculture and agroforestry.

fertile lands (often marginal forests) through extensification. In addition to extensification, policy changes are also promoting input-driven intensification, which strives to get more physical output for the same amount of inputs (or the same output with fewer inputs). External input driven agricultural systems will experience an increase in yields and productivity, this increase however, is often unsustainable. The transition to intensive agriculture may also reduce total soil carbon stocks, and increase emission of greenhouse gases such as carbon dioxide, methane, and nitrous oxide.

The sustainable intensification of agriculture could reduce agricultural encroachment into forests, preserving biodiversity and soil carbon stocks, while satisfying agricultural demand through improved farming practices such as conservation agriculture and agroforestry (Phalan et al., 2011; Pretty et al., 2011). Thus, SI approaches can potentially minimize environmental and long-term economic costs by increasing the efficiency of agricultural systems and contributing to household and ecosystem resiliency. One such option is the use of agroforestry, particularly "fertilizer trees" that introduce new nitrogen (a key component for plant nutrition and growth). Leguminous trees such as *Faidherbia albida* and *Gliricidia sepium*, and woody shrubs such as pigeon peas facilitate the natural conversion of atmospheric nitrogen into fertilizer nitrogen, thus increasing soil fertility and quality. The term "agroforestry" and "fertilizer trees" in this SOW include the use of shrubby legumes and other long-lived "non-tree" nitrogen fixers that increase nitrogen inputs through biological nitrogen fixation. These options differ in their growth rates, total carbon accumulation rates, nitrogen fixation rates, and use, thus providing distinct value options which can influence a small-holder's decision to adopt agroforestry as a strategy to intensify sustainably. It is yet unclear if the adoption of more profitable farming practices offers incentives for farmers to expand their farmland to increase revenue. A recent study suggests that this may indeed be the case, especially in instances where there is a narrow sectoral approach to intensification. Similarly, even in legume-based agroforestry systems, there are tradeoffs between crop production and environmental impacts, which can also be influenced by policy issues such as land and tree tenure issues. While the integration of N_2-fixing trees or crops on farms represents a viable option in many systems, especially in resource-challenged regions such as Sub-Saharan Africa, it is unclear if these systems indeed contribute to low emission agricultural development (Rosenstock et al. 2013).

Wood and charcoal can be critical sources of fuel and income for smallholder farm households. Food-insecure households may also rely on poaching to earn cash and feed their families, particularly during the "hunger months." These practices contribute to deforestation and biodiversity loss and may divert scarce labor and/or capital from farm production. Sustainable intensification strategies that provide biofuel sources (e.g., wood, biogas), reliable food and income security, or incorporate strategies that reduce fuel demands may appear more appealing as options. Alternatively, community woodlots may influence adoption of farm-level agroforestry options. Similarly, market linkages, resource tenure, policy structures, and socioeconomic factors may also impact farm-level decisions (Fischer et al., 2011; Phelps et al., 2013).

Traditional programming approaches most often use farm-level or household-level metrics to measure the outcomes of their programs (e.g. productivity) without considering the impact on the larger landscape. Likewise, community-level decisions on resource use at the landscape scale do not usually consider the impact of such decisions on smallholder farmers or households. Through this integrated research on food security, climate change, and biodiversity

considerations across scales, USAID seeks to better understand these linkages in order to design effective integrated projects and interventions to promote sustainable development.

3. Study Questions

The study will address the following specific questions:

1. In what ways does sustainable intensification, in particular conservation agriculture (CA) and agroforestry (AF) systems, influence encroachment[2] into forested landscapes or protected areas?
2. How do household-level and community- or landscape-level decisions impact or influence each other? For example, do community woodlots reduce the value of on-farm trees, and vice-versa? Do community woodlots provide households with resources thus decreasing resource pressure and encroachment?
3. What are the benefits and tradeoffs of integrated programming across food security, climate change mitigation, and biodiversity conservation? What metrics can be used to improve management of and evaluate the success of such integrated programs?
4. How can the outcomes from integrated projects be linked to regional and national policies and processes?

Additional illustrative questions include:

1. What data are needed to effectively integrate programs across scales and elements? There are currently multiple projects that have generated a wealth of complementary datasets:
    i. How can these datasets be incorporated into farming systems analyses to effectively inform the assessment of agroforestry and conservation agriculture interventions on soil carbon sequestration, avoided deforestation, and biodiversity conservation?
    ii. What are the key data gaps that, when filled, would provide maximum informative value for integrated programing?

2. How do specific SI options (e.g. specific conservation agriculture and agroforestry interventions) affect landscape-scale outcomes for agricultural intensification, climate change mitigation, and biodiversity conservation? SI options include:

    i. Farm-level agroforestry options (such as specific conservation agriculture and agroforestry interventions)
    ii. Community level options (e.g. managed natural woodlots, reforested woodlots)
3. How do land tenure and property rights (LTPR) systems (including rights to trees and carbon) influence adoption of agroforestry options?
4. What are the policy implications of SI technologies?

[2]Encroachment is defined here as opening new lands for agriculture, deforestation due to charcoal, firewood, construction or other use, human/wildlife conflict, and/or poaching of wildlife

i. Can the carbon sequestration and greenhouse gas emission mitigation benefits be estimated robustly enough to inform regional and national REDD+ policies?
ii. How can the on-farm SI activities inform key agricultural policies, such as those on conservation agriculture, agricultural diversification, and input subsidy programs?
iii. How can the information from this study best inform wildlife conservation, management, and biodiversity policies in Zambia?
iv. How can the information from this study best inform joint forest and resource management policies in Zambia?

The study should explicitly address gender and nutrition impacts of SI and natural resource management options, as well as probing the significance of other key socioeconomic variables in terms of adoption, risk, and benefit such as land ownership, primary occupation (e.g., farmer, pastoralist, charcoal merchant), and ethnicity.

4. Project Funding

AFR will provide the primary financial support ($350,000) for the integrated research study described in this SOW. This funding is Sustainable Landscapes funding under our climate change investments, which requires a focus on reduced emissions of greenhouse gases and increased sequestration in landscapes.

This SOW will be a sub-award of the BFS-funded Africa Research in Sustainable Intensification for the Next Generation (Africa RISING) program, which is managed by the International Institute of Tropical Agriculture (IITA). IITA will be one of the two primary implementing partners, along with the Center for International Forestry Research (CIFOR). BFS and USAID/Zambia have combined Africa RISING activities in Zambia with those of the Sustainable Intensification of Maize Legume Systems in Zambia (SIMLEZA) program. The SIMLEZA/Africa RISING project, supported by $900,000 of Feed The Future funding (FY2014), covers a wide range of issues on sustainable intensification in Zambia and will also be the focal point of the project described in this SOW.

In addition, E3 will provide $250,000 of biodiversity funds through an existing agreement with CIFOR for the support of a post-doctoral research scientist that will form part of this study team. This complex set of funding streams, projects, and partners will require that the implementing partners commit attention and resources to coordination and communication and be flexible, responsive, and patient in dealing with the institutional needs of multiple government agencies, NGOs, and CGIAR centers.

5. Methodologies

An advantage of working closely with the SIMLEZA/Africa RISING project is that data on a variety of different SI techniques is already available. This research study will build upon the data already available through this project and others to provide focused information on the key questions linking farm-level and landscape-level impacts.

Focusing on the Eastern and Lusaka Provinces in Zambia, a robust research framework will be developed and specific methods for addressing the research questions will be determined in partnership with USAID. This may take place in a planning workshop involving the partners and USAID/Zambia and USAID/Washington representatives to prioritize key questions and select the most appropriate methodologies for answering those questions. Where appropriate, these methodologies will explicitly address how gender and other key socioeconomic variables shape decisions and outcomes.

Potential approaches include the following:

1. Literature review that describes the current state of knowledge on the landscape-level impacts of SI and identifies gaps in understanding;
2. Inventory and assessment of available datasets in the study regions to evaluate suitability for potential inclusion in the research study. An assessment of data quality should be based on appropriate geographic and landscape coverage and best practices in data collection;
3. Farming and ecological systems analysis linking farm-level and landscape-level impacts, potentially including comparative studies of project and control areas;
4. National and international policy review to explore how particular policies influences farm-level decisions on SI. Illustrative national policies include the Farming Input Support Program (FISP); National Agriculture Investment Plan (NAIP, includes natural resource management and conservation agriculture components); Maize Subsidy Program (Food Reserve Agency); National Joint Program for REDD+ Strategy; and land tenure policies. Illustrative international policies include: REDD+; Regional and International Wildlife Trafficking Strategy; and Comprehensive Africa Agriculture Development Programme (CAADP).

6. Deliverables

Deliverables and timelines for this work will be mutually agreed upon in discussion with key partners, USAID/Zambia, and USAID/Washington. Deliverables may include:

- A final report not to exceed 50 pages
- A PPT summarizing recommendations for integrated programming for USAID
- Seminars at USAID and relevant partner meetings
- Database from the literature review

Any data collected or GIS mapping done specifically for this project should be made available upon request to USAID or USAID partners.

7. Staffing/Management

This study will be implemented under the CGIAR PIO grant, through IITA and CIFOR. They will identify, in consultation with USAID, field partner(s) who will be responsible for coordinating the activities supported under this study in Zambia. Potential partners include COMACO, Africa RISING/SIMLEZA, BioCarbon partners, or universities such as Michigan State University or Wageningen University. IITA and CIFOR will be jointly responsible for submitting all deliverables to USAID.

Because of the number of partners potentially involved in this study, regular coordination calls should be planned from the beginning to ensure that plans to ensure collaboration, communication, and knowledge management are developed from the beginning of the project. Although funding for this proposal is being provided by USAID/Washington, USAID/Zambia will be fully consulted in planning and oversight and may perform site visits or discussions with IITA/CIFOR staff and/or partners in the field.